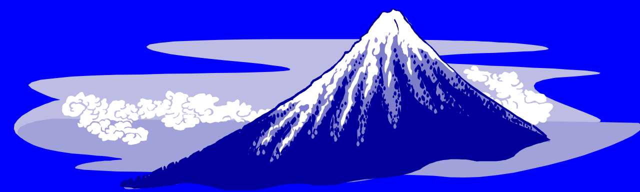
Peak Performance



NWS Office of Climate, Water, and Weather Services
Silver Spring, Maryland

May 2012

This Issue:

STATUS OF SERVICE ASSESSMENT TEAM RECOMMENDATIONS

By Sal Romano, NWS Headquarters

A service assessment evaluates the performance and services of NOAA's NWS offices affected by the hazardous event. It is an evaluative learning tool designed to: (a) identify and share best-case operations, procedures, and practices, and (b) address problems and service deficiencies. It is not intended to be a meteorological/ hydrological study nor a catalog of charts and tables detailing the history of the event.

The service assessment teams provide the problems and service deficiencies they discovered in the form of findings and related recommendations. Findings and recommendations are based primarily on impacts to the public and/or internal impacts on NWS operations and are national in scope. Teams carefully avoid making recommendations on changes to policy or procedure when such changes are already in the process of being implemented by the NWS. Some findings and recommendations may add workload or inconvenience to the offices and/or require procedural changes. If the team thinks that a change will benefit the public, they will recommend it even at the expense of NWS.

The NWS's Office of Climate, Water, and Weather Services' (OCWWS) Performance Branch in coordination with the service assessment team leader compose action items for each recommendation in the service assessment report. Action items are assigned to various

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Status of Service Assessment Team Recommendations - Continued from Page 1

entities within the NWS who are responsible for implementing them. The OCWWS Performance Branch is responsible for tracking the progress of each action item until it is completed. The status of each action item is regularly reported to the NWS's Corporate Board.

Many improvements have been made in the NWS resulting from the implementation of service assessment action items. This article will focus on a few recommendations, action items, and their current statuses related to the spring season (i.e., tornado outbreaks, river flooding, and flash flooding).

Tornado-Related Action Items

Recommendation: The NWS should communicate with Emergency Managers (EM) and other key decision-makers to highlight unusual or fast-changing situations involving extreme weather events.

Action: All WFOs should modify their severe weather operations plan to specifically call for the use of rapid communication methods (e.g., telephone, NWSChat) to exchange information about unusual or fast-changing situations involving extreme weather with EMs and other key decision makers.

Status: Severe weather operations plans for WFOs in all regions now include information on the use of rapid communication methods (e.g., phone, NWSChat, HAM radio systems, email updates) to provide hydrometeorological information regarding unusual or fast-changing situations with EMs and other key partners/ decision makers.

Recommendation: The NWS should emphasize to EMs and other key decision makers that an entire area in and near a warning polygon is under risk of the warned phenomenon. Decision-makers should be concerned with the entire warned area.

Action a: Modify phrasing in Storm-based warnings to state "*the entire area in and near a warning is under risk*."

Status a: The tri-agency (NWS, U.S. Army Corps of Engineers [USACE], U.S. Geological Survey [USGS]) preparedness guide "*Thunderstorms, Tornadoes, Lightning...Nature's Most Violent Storms*" and the "*Storm-Based Warnings*" flyer were extensively updated and widely distributed. These two publications are available to EMs and the general public.

Action b: Develop and distribute education and outreach materials for EMs and other key decision makers to explain in detail the concept of Storm-based warnings and discuss impacts in and around the area of the warning.

Status b: Revised the "*Storm-Based Warnings*" flyer that emphasizes "*all locations in a warning polygon are threatened, requiring immediate action to protect life and property*." It has been posted to the Integrated Database for Education and Awareness (IDEA) as a resource for NWS Warning Coordination Meteorologists (WCM).

Recommendation: Training for EMs and SKYWARN spotters needs to stress that right-turning storms can result in south of east motion. (In operational meteorology, this is called a "*right turning*" thunderstorm and is an indication a thunderstorm's rotation has become strong enough to cause it to veer in a direction different from the ambient steering winds.)

Action b: Develop and distribute education and

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outreach materials for EMs and other key decision makers that educate on how right-turning storms can result in south of east motion, or other atypical storm motions right of the expected path.

Status: This action item was addressed through the update of the tri-agency booklet "*Thunderstorms...Tornadoes...Lightning... Nature's Most Violent Storms*," as discussed earlier in this article.

Recommendation/Action: NWS should develop education and outreach material encouraging people to notify family, friends, and neighbors of the danger without jeopardizing their own safety. The educational and outreach material should also emphasize the importance of immediately acting upon a single source of information when the communicated threat is imminent.

Status: The NWS's "*Nature's Most Violent Storms*" severe weather preparedness guide addresses this concept extensively when describing how to develop an "*Emergency Plan*" (starting on page 15). The exact language used in this preparedness guide was coordinated between the NWS, FEMA, and the American Red Cross, including their risk communication experts. The information in the "...*Nature's Most Violent Storms*" publication has been shared nationally with the emergency management community including the International Association of Emergency Managers. WCMs' outreach and education will continue to encourage users to take this action.

Recommendation: Because of differing views of relative location between those issuing the watches and warnings and those receiving them, verbal and written descriptions of locations at risk need to be carefully crafted and anticipated supplemented with graphics that depict the location as well as the uncertainty. NWS should work with communications experts to test various modes of presentation and dissemination of this kind of information.

Action Item: Establish new requirements for the Hazard Information Services team to work with communication and behavioral experts and develop watch and warning products that include visual and verbal descriptions of locations at risk and uncertainty information.

Status: The Integrated Hazard Information Services (IHIS) is a NWS computer software development project for a set of tools intended to improve the reciprocal exchange of weather information among emergency managers and their partner groups during weather-related emergencies. IHIS is planned to replace the three separate computer software applications currently used by NWS meteorologists to issue hazardous-weather watches, warnings, and advisories. These requirements stemming from this action item have been included in the IHIS software development Concept of Operations/Operation Requirements Document.

<u>River Flooding-Related and Flash Flooding-Related Action Items</u>

Recommendation/Action Item: The NWS should ensure modeling and modification capabilities within the Community Hydrologic Prediction System (CHPS) architecture include the ability for the user to make adjustments or extensions to the rating curve and be able to examine easily the impacts of these adjustments or extensions on the resultant forecast hydrograph. (Rating curves are also known as ground-truth, river stage-flow relationships.)

Status: CHPS now includes the necessary

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Status of Service Assessment Team Recommendations - Continued from Page 3

modeling and modification capabilities to make the required adjustments to the rating curves. The features were tested by North Central River Forecast Center.

Recommendation: The NWS should develop a real-time process to alert WFOs and RFCs when levees are overtopped or fail.

Action Item: OCWWS Hydrologic Services Division (HSD) will assess the feasibility of a real-time process to alert WFOs and RFCs when levees are overtopped or fail.

Status: HSD has assessed the feasibility and determined that a real-time process of alerting WFOs and RFCs when levees are over-topped is not possible without system interoperability and data synchronization. Under the auspices of the Integrated Water Resources, Science and Services. (IWRSS), the NWS anticipates establishing system interoperability and data synchronization in the next five or more years. Currently, various communication tools and techniques (e.g., NWSChat, inter-agency Fusion Team activities, coordination calls, email, and other communication mechanisms) are used to share this information in near real time.

Recommendation/Action Item: The NWS should evaluate policy regarding terminology used to describe rare events to ensure the information conveyed is statistically sound, and meaningful to partners and users. This should include an evaluation of the effectiveness of using probability of occurrence information (1% chance of occurrence) vs. expected return frequency information (100-year event).

Status: Based on input from the International Association of Emergency Managers (IAEM) and National Hydrologic Warning Council (NHWC), NWS updated NWSI 10-922 to specify appropriate terminology for expressing flood frequency (e.g., 1% chance flood).

Recommendation: The NWS should develop enhanced hydrometeorological monitoring and situational awareness tools to help forecasters recognize the extreme nature of unusual events by providing comparisons against critical values, historical events, and climatology, sending alerts when user-selected thresholds are reached. The system would be comparable to the way the Flash Flood Monitoring and Prediction System (FFMP) compares precipitation amounts to flash flood guidance and the River Gage Alert and Alarm program compares observed river stages to locally determined stage thresholds.

Action Item a: Implement and evaluate a distributed modeling technique at demonstration sites such as WFOs Pittsburgh, Binghamton, and Sterling.

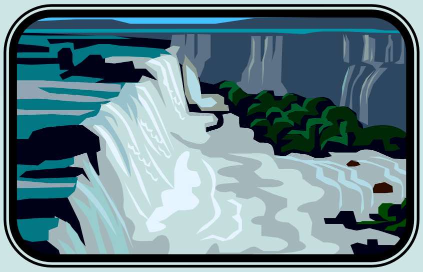
Status: A distributed modeling technique is running at WFOs Binghamton, NY; Pittsburgh, PA; and Sterling, VA.

Action Item b: Define procedures for inclusion of precipitation frequency data in FFMP.

Status: The procedures were developed. OCWWS HSD will provide the procedures and training via Webinar to NWS field offices.

Action Item c: NWS regions should ensure all WFOs are in compliance with Annual Office Training Plan per policy (NWSI 20-106) including hydrology training.

Status: Issue addressed on routine HSD teleconferences and NWS regions provided assurance of WFO compliance.



Ensemble River Forecast Verification Activities at MARFC

By Andrew Philpott, Middle Atlantic River Forecast Center

I have been working with James D. Brown from the Office of Hydrologic Development on using OHD's Ensemble Verification Software (EVS) to analyze various Middle Atlantic River Forecast Center (MARFC) ensemble river forecasts. In particular, we've been focusing recently on the Short Range Ensemble Forecast (SREF) based river forecasts produced at MARFC, of which we have three years of forecasts archived. I have only started looking at confidence intervals which indicate the statistical significance of verification results.

However, even without statistical significance information, we can begin to see some patterns in the results. We put together a poster for the 2012 American Meteorological Society Annual Meeting, which was presented by MARFC Hydrologist In Charge Peter Ahnert in New Orleans. The poster and an extended abstract can be found on the AMS Meeting Website at:

http://ams.confex.com/ams/92Annual/webprogram/Paper199532.html

We have been analyzing various river ensembles produced by running ensembles of temperature and precipitation forcings through the river model. All of these ensembles have shown strengths in discriminating between high water events and low water events. But we've also observed patterns of underspreading and conditional biases in all of these ensembles. Underspreading means that the forecasts are too confident, such that the observed value may fall outside the spread of ensemble members. Conditional biases included a tendency to underforecast high streamflows and overforecast low streamflows **(Figure 1).** Verification of the precipitation and temperature forcing ensembles themselves has revealed that some of the spread and bias limitations are due to underspreading and conditional bias in the forcings. However, it is clear that uncertainties in hydrologic modeling also contribute. These include variations in the intensity of the precipitation within the 6 hour

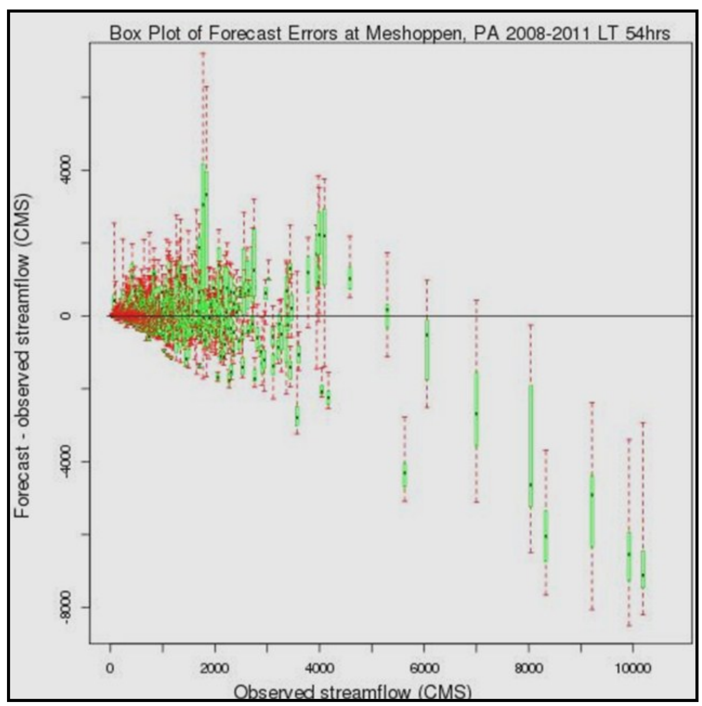


Figure 1: This is a picture of conditional biases and under-spreading from the OHD Ensemble Verification System. Portions of boxes falling below the x-axis are underforecasts, and portions above are overforecasts.

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Ensemble River Forecast Verification Activities at MARFC– Continued from Page 5

modeling timestep, sub-basin spatial variability in hydrologic parameters and precipitation, unaccounted for variability in initial soil moisture, and routing uncertainties. Varying hydrometeorological inputs alone cannot account for all of these uncertainties.

An ensemble post-processor should be able to improve biases and underspreading that cannot be overcome only by varying input forcings. In fact, such a post-processor will be part of the Hydrologic Ensemble Forecast Service (HEFS) being developed by OHD. Verification can be used to evaluate post-processed ensembles as well. Since verification is such an important part of effective ensemble river forecasting, verification (EVS) is being integrated into HEFS.

At MARFC, we have experimented with the verification of various river ensembles, and uncovered interesting results. There is much more work to be done, especially in verifying more river forecast points under longer data records, in developing a good understanding of all the verification metrics provided by EVS, and in using confidence intervals to identify statistically significant results.

A Method to Incorporate Analysis Uncertainty into Real Time Grid Verification

Dave Radell, Eastern Region Headquarters

A simple method to take the Real Time Mesoscale Analysis (RTMA) uncertainty information into account for the verification of public National Digital Forecast Database (NDFD) grids was recently rolled out as part of Eastern Region's Real Time Grid Verification Project. Eastern Region uses the RTMA as the "gridded observed field" to assess the quality of its gridded forecasts. The RTMA uncertainty fields provide a range of values within which the true observation is most likely to be, and are available for select elements each hour at every grid point. Greater analysis uncertainty exists at an "observed" RTMA value at a given grid point if the background field is high. The analysis uncertainty value is a function of the RTMA's systematic, observational, and first guess errors. Forecast verification should take into account this analysis uncertainty, giving more leeway to the forecast at grid points where the analysis is less certain. In addition, there is a need to move away from using set error intervals for identifying when grid forecasts are considered "good enough" or in defining the criteria for a forecast "bust" (e.g., a set exceedance value of, say, ±4°F for temperature or dewpoint forecasts).

A more robust method using uncertainty intervals, constructed from the RTMA analysis uncertainty fields, is presented here. The RTMA uncertainty value is considered to represent one standard deviation about the RTMA grid point value. For example, an RTMA temperature value of 32°F with ±3°F uncertainty would become an uncertainty interval of 29°F to 35°F. The "true" RTMA temperature is likely to fall anywhere within this interval. Grid forecasts that fall

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A Method to Incorporate Analysis Uncertainty into Real Time Grid Verification – Continued from Page 6

within this interval might be considered a "hit," while those far outside (±2 standard deviations) a "miss." Those grid forecasts that fall between ±1 and ±2 standard deviations might be considered a "good enough forecast" or a "near miss." This process is repeated at each forecast grid point as the RTMA uncertainty changes over time at each point.

Example plots from recent NWS gridded dewpoint forecasts are provided in Figures 1 and 2 from a case where a strong cold front passed through the northeast United States, leading to a significant drop in dewpoint temperatures over 24 hours. The grid dewpoint forecasts at Islip, NY generally reflect this dewpoint drop well **(Figure 1).** Also, and both the 3- and 12- hour dewpoint forecasts are consistently within the first uncertainty interval about the RTMA dewpoint temperature, and are forecast "hits" when the RTMA uncertainty is considered. At 27/0000, the 12-hr dewpoint forecast could be considered a near miss (or alternatively, "good enough"), falling just outside the first forecast uncertainty interval.

An example of a dewpoint "miss" for a three hour forecast valid at 27/0000 is shown in Figure 1.

It is important to note that while the dewpoint forecasts over the period might be considered "hits" if incorporating RTMA uncertainty, significant differences from the RTMA "most likely observed" value can still exist **(Figure 2a)**. Three-hour dewpoint temperatures valid at 26/1500 UTC were underforecast in the NDFD grids (blue shading, Figure. 2a) by some 5-7 °F, from Cape Cod south to Delaware Bay, compared to both the RTMA dewpoint and KISP ASOS. So while the forecast dewpoint at KISP could be considered a "hit" by verifying with the analysis uncertainty interval (Figure 1), a difference still exists between the forecast value and the "most likely observed" RTMA value (6°F at 26/1500). A spatial plot at every grid point for the three hour NDFD dewpoint forecast difference, color-coded to show trouble spots, gives forecasters a quick "heads up" look as to whether their grid forecasts are in the ballpark of the RTMA, taking analysis uncertainty into account **(Figure 2b)**.

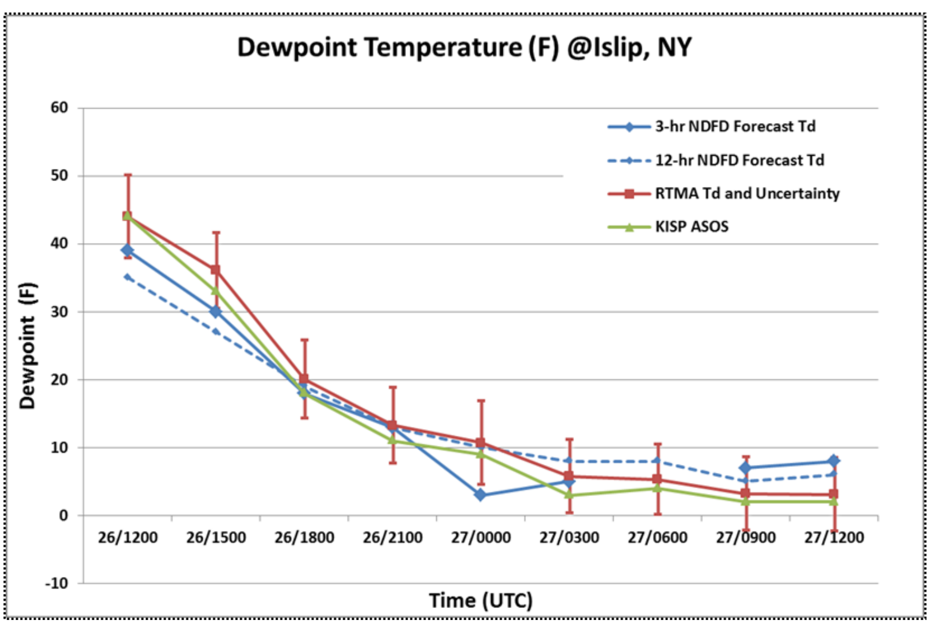

Figure 1: Dewpoint temperature trace and RTMA analysis uncertainty bars (°F) at Islip, NY (KISP) valid March 26-27, 2012. Note that the 3- and 12-hour NDFD dewpoint forecasts for the given valid time are indicated by solid and dashed blue curves, respectively. The blue square at 27/0000 UTC indicates an example dewpoint forecast exceeding two uncertainty intervals. The 3-hour NDFD forecast is missing at 27/0600 UTC, and the magnitude of the RTMA dewpoint uncertainty interval is on order of 5-8 °F.

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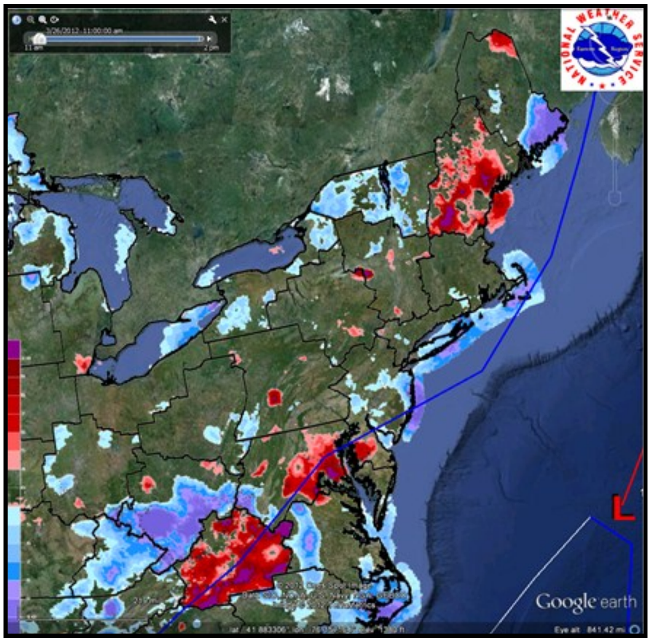
A Method to Incorporate Analysis Uncertainty into Real Time Grid Verification - Continued from Page 7

2a)



2b)

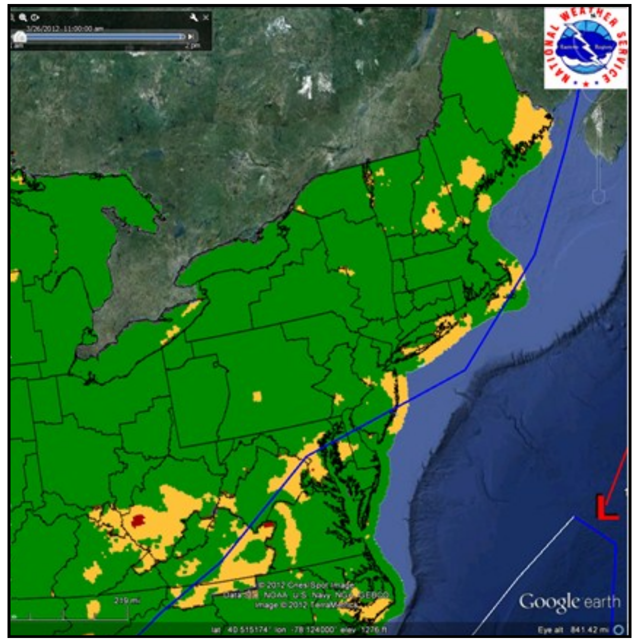


Figure 2a: Dewpoint difference (3-hr NDFD forecast - RTMA analysis) with NCEP fronts valid at 1500 UTC 26 March 2012. A fixed exceedence interval of ±4°F is used, and only NDFD forecast differences of greater or less than ±4°F are shaded.

Figure 2b: NDFD dewpoint forecast verification considering RTMA uncertainty. A forecast "hit" (green; within one standard deviation), "miss" (red; outside two standard deviations) or "near miss" (yellow; between one and two standard deviations), as in Figure 1 for each grid point, is color coded for a situational awareness plot. The white star indicates Islip, NY (KISP). Images are taken from the Eastern Region Real Time Grid Verification Display.

The method introduced here is meant only to serve as a springboard for additional work in this area, as the magnitude of the RTMA analysis uncertainty appears to be inflated, and is still undergoing calibration and further development of a more accurate observational error technique by the developers at NCEP. However, the uncertainty fields may still serve as useful estimates of error in the analysis, and provide information about the range of potential values associated with the deterministic RTMA value for use in grid verification.

Perfection is not attainable,
but if we chase perfection we can catch excellence.
Vince Lombardi

Performance Branch Gets a Lesson in VSL

By Doug Young, NWS Headquarters

Is VSL just another acronym we need to memorize? It sure didn't look familiar the first time I saw it in an invitation to a workshop. A quick Google search revealed that VSL could be the "variable speed of light," a "virtual storage layer," a "probiotic medical food for the dietary management of colitis," or the "Vienna Symphonic Library." None of those topics seemed related to the Performance Branch (albeit at times a probiotic medical food to manage colitis probably could have come in handy). Upon closer examination, however, the purpose of this particular workshop was the exchange of information among federal agencies on the Value of Statistical Life (also known by the acronym VSL). In brief, VSL is the value that government agencies use to evaluate the importance of regulation or legislation. It is the "official" statistical value that your life is worth to an agency.

The concept seemed intriguing and relevant to the statistics we manage. So, Brent MacAloney and I (along with a few other folks from NWS and NOAA) responded to the invitation. On March 19-20, 2012, we headed to Bethesda, MD, and participated in this U.S. Nuclear Regulatory Commission-sponsored workshop. The objective was to learn and discuss how various organizations determine the basis for the Value of Statistical Life (VSL), as well as how it is used. Participating agencies included NRC, EPA, USDOT, FDA, DHS, USDA, DOE, and NOAA. Because of the sensitive subject matter, this workshop was "by invitation only," which we were constantly reminded of by the armed guard we passed each time we entered or exited the conference room.

Prior to the meeting, agencies were given six topical questions and had the opportunity to respond to them in the basis of their presentations. These topical questions were as follows:

- What VSL does your organization use and what is the basis for it?
- How does your organization apply the VSL?
- What general challenges does your organization face with regard to applying VSL?
- What is your agency's process for updating the VSL? (e.g., frequency, methodology, etc.)
- How does your agency communicate VSL concepts to the public? What challenges have you faced?
- What future research plans does your agency feel is most pressing with regard to VSL?

Based on the presentations, the EPA seemed to be the lead agency with respect to using VSL and several of the agencies were satisfied using their calculated value. In 2010, the EPA introduced a publication entitled, *Guidelines for Preparing Economic Analyses* **http://goo.gl/mZyCP**. In those guidelines, the EPA recommends a VSL central estimate of … <drumroll> …$7.4 million in 2006 dollars and $7.9 million in 2008 dollars. These values are based on several studies, but primarily derived from foundational studies dating back to the mid to late1970s. Other agencies use different values (e.g., FDA currently uses a VSL of $7.4 million in 2006 prices and the U.S. Coast Guard uses a VSL of $6.3 million). These are all,

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Performance Branch Gets a Lesson in VSL - Continued from Page 9

within the acceptable range recommended by OMB Circular A-4 http://goo.gl/u5kN1, which indicates the range of VSL can be anywhere from $1 million to $10 million—quite a broad range!

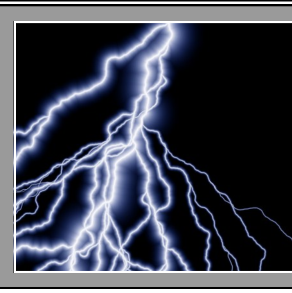
As you could imagine, the "value of statistical life" term has been a source of both confusion and anxiety throughout the years. This is not only because it is often interpreted incorrectly as the value of a human's life, but also because of the large variation in estimates used by economists and statisticians across all educational institutions and federal agencies. **In reality, VSL is the tradeoff of money for a reduction in the probability of death by individuals.** That is, how much money is one willing to give up to avoid potentially fatal risks? The ratio of the money someone is willing to give up in exchange for a small reduction in the probability of a fatality is expressed in units of "dollars per death" or the dollar value of a fatality. Without going into too much detail, one can see how this is important to government leaders when trying to determine the cost-benefit of large investments. More explicitly, will the investment be worth the statistical value of potential lives saved? Obviously, VSL is not directly observable, so indirect methods must be used for measurement. VSL varies across individual with different preferences, across income levels, and even over the life cycle.

While NOAA did not make a formal presentation, Brent and I schlepped up front and shared our interest in VSL, siting potential uses in Storm Data and impact-based verification. Weather is always interesting to other agencies and we answered various weather-related questions as well. Overall, we found the discussion both interesting and enlightening. It also afforded us the opportunity to meet with other agency representatives and exchange ideas. Of particular interest to us was the Coast Guard's Consequence Equivalency Matrix, which includes various impact types and severity levels and could be a useful template to help establish NWS all-hazard risk profiles.

For more information and examples of VSL, an interesting and easy to read article is available on **Stats.Org** written by Rebecca Goldin Ph.D and Cindy Merrick, on June 27, 2011. You can access this article at the following URL: http://goo.gl/iPU8G

You can do what you have to do, and sometimes you can do it even better than you think you can. - Jimmy Carter

The End of an Era in the Storm Data Publication



By Brent MacAloney, NWS Headquarters

As the old saying goes "All good things must come to an end." Such is the case for the "Outstanding Storm of the Month" (OSM) section of the *Storm Data Publication*. Over 30 years since the OSM became a fixture in the monthly *Storm Data Publication*, a decision was made to discontinue it beginning with the November 2012 publication because of budgetary shortfalls and lack of OSM submissions from the NWS field offices.

For the history buffs out there that are disappointed to see the OSM being discontinued, I figured I would give you some background on the history of the *Storm Data Publication* and how the OSM came to be, as it was not always part of the publication.

As many of you are well aware, the *Storm Data Publication* was first published back in January 1959. The original publication was only eight pages long back then. Compare that to the April 2012 publication which was over 1,200 pages long and it is absolutely amazing to consider how much the publication has grown over the last 50+ years. Prior to 1959, *Storm Data and Unusual Weather Phenomena* was section in the *Climatological Data National Summary* and a decision was made at that point to break it out into its own publication. That was the birth of the *Storm Data Publication*.

It wasn't until 1981 that the OSM became a regular part of the *Storm Data Publication*. Very much like the situation the Federal Government is in right now, back in 1981 NOAA was going through some tough times with the budget. A cost cutting decision was made to discontinue the *Storm Data Publication* and the following message was displayed on the cover of the May 1981 issue:

> *THIS PUBLICATION HAS BEEN FUNDED, PRIMARILY, THOUGH DIRECT APPROPRIATIONS FROM CONGRESS. BUDGET REDUCTIONS FOR FISCAL YEAR 1982 NECESSITATE ITS TERMINATION WITH THE JUNE 1981 ISSUE.*

So with the *Storm Data Publication* breathing its last breathes of life, in swooped Dr. Theodore Fujita to save the day at the 11th hour. In the July 1982 *Storm Data Publication* you can find the following message:

> *Storm Data, which had been slated to end with the June 1981 issue, is given a new lease on life in a revised and expanded format. Coordination among the National Climate Center, the National Weather Service, and Dr. T. Theodore Fujita, Professor of Meteorology at Chicago University and an acknowledged tornado authority, has made this possible.*
>
> *Beginning with the July 1981 issue, Dr. Fujita will review the reports provided by the National Weather Service; assign tornado F scale numbers, and add narratives and pictures on outstanding*

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The End of an Era in the Storm Data Publication– Continued from Page 11

storms. NWS narratives on tropical storms will also be carried. That National Severe Storms Forecast Center will also participate in the review. Storm Data will be published by the NCC after these reviews, but likely with a slightly longer time lag.

The first OSM of the month was actually "storms" in that it included the following storms:

- RAINSTORM in Washington D.C. and Vicinity on July 3 – 4 **(Figure 1)**
- TORNADO AND HIGH WINDS in South Dakota on July 19
- TWO TORNADOES in Eastern Pennsylvania on July 20 and 26
- TORNADO southwest of Bismarck (sic) N.D. on July 30 **(Figure 2)**
- Lake Pontchartrain WATERSPOUT on July 4 Chantilly, Va. TORNADO of July 28

Write-ups on these original OSMs varied in length from a half a page with a couple of paragraphs and a graph, to a two page report showing the track of a tornado and multiple pictures of the damage caused.

Over the years the OSM morphed from an Outstanding Storms of the Month showcase to an Outstanding Storm of the Month in which a single storm was featured. Unfortunately, as the number of reports logged into the storm events database grew month by month, the amount of time storm data focal points had to document submissions for OSMs began to shrink. It reached the point where NCDC was having a hard time getting offices to submit OSMs. Couple that with the fact that the Storm Data Publication editors at NCDC were spending 2-3 days a month on editing, formatting, and creating graphics for the OSM and it was a likely candidate for the budgetary chopping block.

One of the last events featured as "Outstanding Storm of the Month" was the Joplin, MO tornado of May 22, 2011 **(Figure 3)**, which killed 159 people.

The OSM served its purpose and served it well during the 30+ years it graced the pages of the Storm Data Publication. As I said in the beginning of this article though, all great things

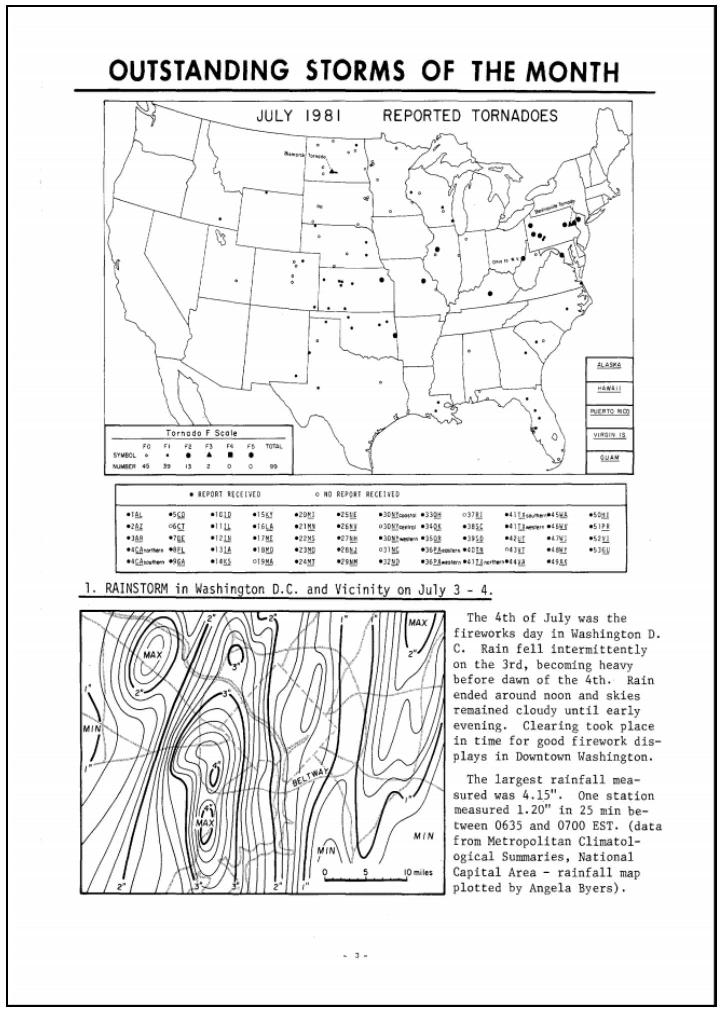

Figure 1: The first page of the original Outstanding Storm of the Month as printed in the July 1981 Storm Data Publication showing all the tornadoes from the month, as well as a "rainstorm" event occurring in Washington, DC.

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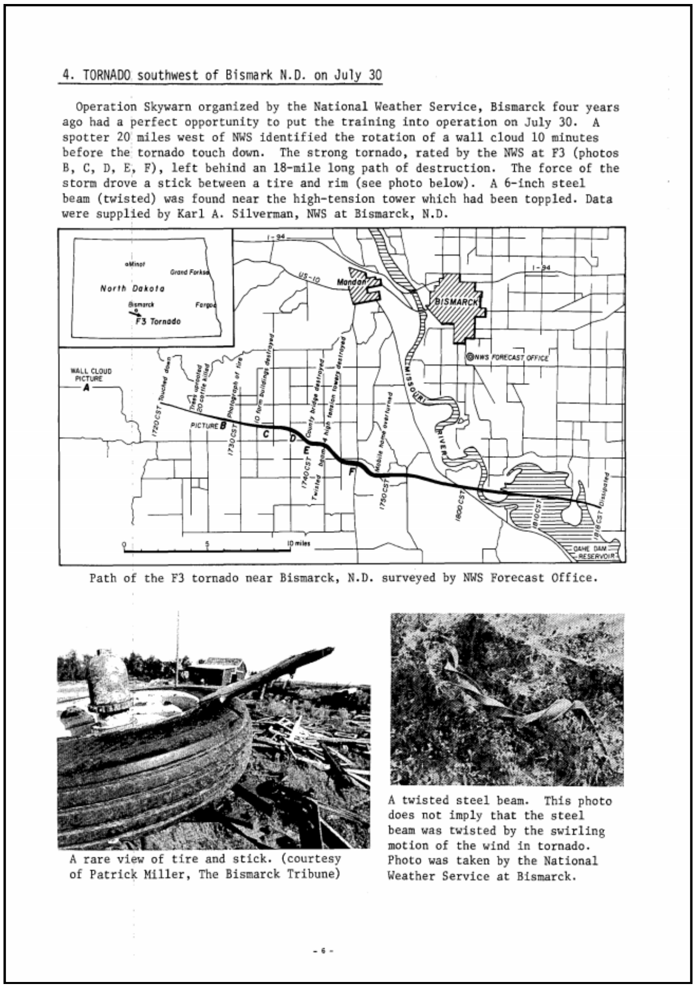
The End of an Era in the Storm Data Publication- Continued from Page 12

must come to an end. As we saw back in 1981, endings can, and often do, lead to some sort of beginning. The year 2012 brings a new chapter to the life of the Storm Data Publication. Like many of you, I'm curious to see what the future holds.



4. TORNADO southwest of Bismark N.D. on July 30

Operation Skywarn organized by the National Weather Service, Bismarck four years ago had a perfect opportunity to put the training into operation on July 30. A spotter 20 miles west of NWS identified the rotation of a wall cloud 10 minutes before the tornado touch down. The strong tornado, rated by the NWS at F3 (photos B, C, D, E, F), left behind an 18-mile long path of destruction. The force of the storm drove a stick between a tire and rim (see photo below). A 6-inch steel beam (twisted) was found near the high-tension tower which had been toppled. Data were supplied by Karl A. Silverman, NWS at Bismarck, N.D.

Path of the F3 tornado near Bismarck, N.D. surveyed by NWS Forecast Office.

A rare view of tire and stick. (courtesy of Patrick Miller, The Bismarck Tribune)

A twisted steel beam. This photo does not imply that the steel beam was twisted by the swirling motion of the wind in tornado. Photo was taken by the National Weather Service at Bismarck.

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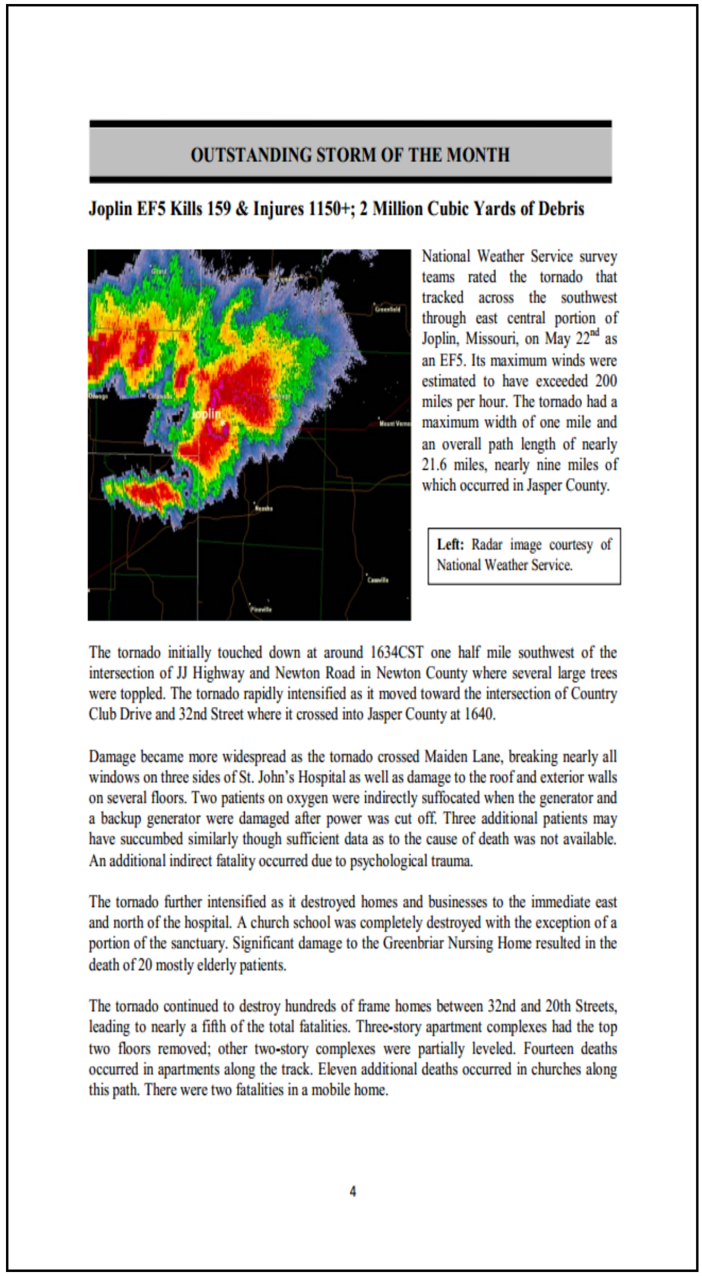
Figure 2: The fourth page of the original Outstanding Storm of the Month as printed in the July 1981 Storm Data Publication showing the track of a tornado occurring southwest of Bismarck, ND.



OUTSTANDING STORM OF THE MONTH

Joplin EF5 Kills 159 & Injures 1150+; 2 Million Cubic Yards of Debris

National Weather Service survey teams rated the tornado that tracked across the southwest through east central portion of Joplin, Missouri, on May 22nd as an EF5. Its maximum winds were estimated to have exceeded 200 miles per hour. The tornado had a maximum width of one mile and an overall path length of nearly 21.6 miles, nearly nine miles of which occurred in Jasper County.

Left: Radar image courtesy of National Weather Service.

The tornado initially touched down at around 1634CST one half mile southwest of the intersection of JJ Highway and Newton Road in Newton County where several large trees were toppled. The tornado rapidly intensified as it moved toward the intersection of Country Club Drive and 32nd Street where it crossed into Jasper County at 1640.

Damage became more widespread as the tornado crossed Maiden Lane, breaking nearly all windows on three sides of St. John's Hospital as well as damage to the roof and exterior walls on several floors. Two patients on oxygen were indirectly suffocated when the generator and a backup generator were damaged after power was cut off. Three additional patients may have succumbed similarly though sufficient data as to the cause of death was not available. An additional indirect fatality occurred due to psychological trauma.

The tornado further intensified as it destroyed homes and businesses to the immediate east and north of the hospital. A church school was completely destroyed with the exception of a portion of the sanctuary. Significant damage to the Greenbriar Nursing Home resulted in the death of 20 mostly elderly patients.

The tornado continued to destroy hundreds of frame homes between 32nd and 20th Streets, leading to nearly a fifth of the total fatalities. Three-story apartment complexes had the top two floors removed; other two-story complexes were partially leveled. Fourteen deaths occurred in apartments along the track. Eleven additional deaths occurred in churches along this path. There were two fatalities in a mobile home.

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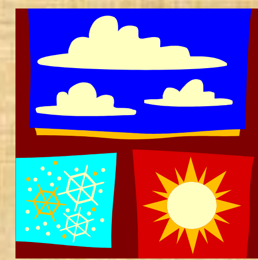
Figure 3: One of the last OSM's which featured the May 22, 2011 Joplin, MO tornado, which killed 159 people.

You can see the event that was slated to be the Outstanding Storm of the Month for November 2011 located on page 16 of this

Late Spring Edition of Peak Performance.

Fly…with Ointment



Beth McNulty, NWS Headquarters

This episode…What is product realization?

Quality management systems (QMS) work best when there are defined products for customers. Two definitions are needed to ensure that first sentence makes sense. First, what is a customer? Second, how does the customer influence product development? A customer is a "consumer, client, end user, or beneficiary" of a product or service. Each customer has certain needs, called requirements, for a product that must be met before a product is useful to them. The process of adapting to the customer's needs leads to product realization.

An organization may adjust an existing product, or develop a new one to fit customer requirements. To do this the producer must know what the customer needs, and what existing program comes closest to meeting that need? The feedback element of QMS allows the customer iterative input to the producer to ensure the resulting product, or service, captures, and answers the customer requirements. This transformation of requirements into a product or service is called "product realization."

Let's bring the concept of product out of the abstract with a real example. Currently, the Performance Branch is working with the U.S. Navy on verification of Navy TAFs. The Navy could, for a lot of money, develop a TAF verification program similar to the NWS Stats-on-Demand. Or, the Navy could, for less money, access the existing NWS *Stats on Demand* through a customized graphical user interface. Assuming the required paperwork is in place, the product to be created is the interface for the Navy. How well the interface meets the Navy requirements is a quality issue managed through the QMS.

In the next edition of Peak Performance, we will examine the following area of the Quality Management System-

The importance of customer input.

Service Assessment Program

By Sal Romano, NWS Headquarters

One service assessment was signed by the NWS Director in March 2012 and another service assessment team is currently finalizing their report. Here is a summary of the status of these two service assessment reports:

1) Spring 2011 Middle and Lower Mississippi River Valley Floods

This service assessment document presents findings and recommendations regarding NWS performance during the historic river flooding that occurred in the Mississippi River Valley during the spring of 2011. The areas most impacted were the lower reaches of the Ohio River and associated tributaries, as well as areas from the confluence of the Mississippi River and Ohio Rivers at Cairo, IL downstream to the Gulf of Mexico. A combination of runoff from upstream snowmelt and excessive spring rainfall combined to adversely impact property and commerce over a broad geographic area.

The service assessment document was signed by the NWS Director, Jack Hayes, in March, 2012 and was released to the public in April.

2) NOAA NWS Operations and Service Assessment during Hurricane Irene in August 2011

On Saturday, August 20, 2011 Hurricane Irene was a tropical wave east of the Lesser Antilles. Irene affected the U.S. Virgin Islands and Puerto Rico first as a tropical storm and then strengthened into a Category 1 hurricane late Sunday night (August 21) and on Monday morning, August 22. The storm continued to strengthen into a Category 2 hurricane and then began to weaken before making landfall near Cape Lookout, NC on the morning of August 27, 2011 as a Category 1 hurricane. After moving across the Outer Banks of North Carolina and extreme Southeastern Virginia, Irene traveled off the Eastern Seaboard until reaching Little Egg Inlet on the New Jersey Coast where it made landfall early Sunday morning, still as a Category 1 hurricane. By 9 am, Sunday morning (August 28) Irene, now a tropical storm with 65 mph winds, was centered over New York City. Irene continued to travel northeast through New England and reached the Canadian border as an extra-tropical cyclone, with sustained winds of 50 mph, around Midnight Sunday. Irene traveled through eastern Canada on Monday, August 29. In addition to producing strong, damaging winds along its path, Irene dropped copious amounts of rain, and produced damaging storm surges.

The service assessment team is focusing on those locations most severely affected by the weather-related impacts of Irene. These include the U.S. Virgin Islands, Puerto Rico, and North Carolina to southeastern Canada.

The service assessment is scheduled to be briefed by the team leaders to the NWS Corporate Board and NOAA representatives on June 26, 2012.

The Bering Sea Storm

Outstanding Storm of the Month

Corey Bogel, WFO Fairbanks, Alaska

This article was slated to be featured in the "Outstanding Storm of the Month" (OSM) section of the monthly Storm Data Publication. After 30 years in existence, this publication has been discontinued (full story on page 11) beginning with the November 2011 publication.

A Bering Sea storm of historical proportions affected nearly every community along the west coast of Alaska from November 7-10, 2011. A 960 mb low over the southern Aleutians at 0300AKST on the 8th intensified to 945 mb near the Gulf of Anadyr by 2100AKST on the 8th. The low crossed the Chukotsk Peninsula of far eastern Russia as a 956 mb low at 0900AKST on the 9th, and moved into the southern Chukchi Sea as a 958 mb low by 2100AKST on the 9th. The low then tracked to the northwest and weakened to 975 mb about 150 miles north of Wrangel Island by 1500AKST on the 10th. The storm was one of the strongest storms to impact the west coast of Alaska **(Figure 1)** during the last 40 years, and has been compared to the November 1974 and October 2004 super storms.

The storm produced blizzard conditions and high winds along the west coast of Alaska as well as coastal flooding in many communities along the Bering Sea. The National Weather Service forecast office in Fairbanks, Alaska issued coastal flood watches on the afternoon of the 6th that were upgraded to coastal flood warnings early on the morning of the 7th. Coastal flood warnings remained in effect until the evening of the 10th. The coastal flood warnings verified with over 2 days of lead time in some areas. In addition, numerous blizzard, winter storm, and high wind watches and warnings were issued for this major storm with lead times of up to 2 days.

Coastal flooding was observed from the northern Kuskokwim Delta coast to as far north as Kivalina along the Chukchi Sea Coast. The most severe coastal flooding occurred along the southern Seward Peninsula Coast east of Nome **(Figure 2)**. Portions of the Nome-Council Road were heavily damaged by debris from the coastal flood, with severe erosion of the surface and embankment along with washed away riprap and soil contamination. Road damage is estimated at $24 million. The community of Golovin was particularly hard hit with a significant amount of flooding in the downtown area. The storm resulted in one fatality along the Bering Strait Coast. A 26-year old man is presumed drowned after the four-wheeler he was driving along the beach near the village of Teller was hit by a large wave, and neither he nor his body could be located.

The high winds caused power outages and minor to moderate wind damage along the west coast of Alaska. The highest winds likely

Continued on next page…

The Bering Sea Storm—Outstanding Storm of the Month – Continued from Page 16

occurred along the Bering Strait Coast where wind gusts as high as 89 mph were observed at Wales. There were unconfirmed reports of wind gusts to 93 mph at Little Diomede, and to 125 mph at a wind farm located along the Bering Strait Coast, but information is not available as to the siting and location of these weather stations. Most communities along the immediate coast experienced wind gusts of 60 to 80 mph. The high winds combined with snow to produce severe blizzard conditions in many areas. The most severe blizzard conditions likely occurred at Point Hope where winds gusted to 85 mph causing major power and phone line outages lasting up to 2 days. Several small shacks and fishing boats were blown away in the storm. At one point during the storm, nearly 550 people out of a village of 674 (82%) were evacuated to the emergency shelter at the school.

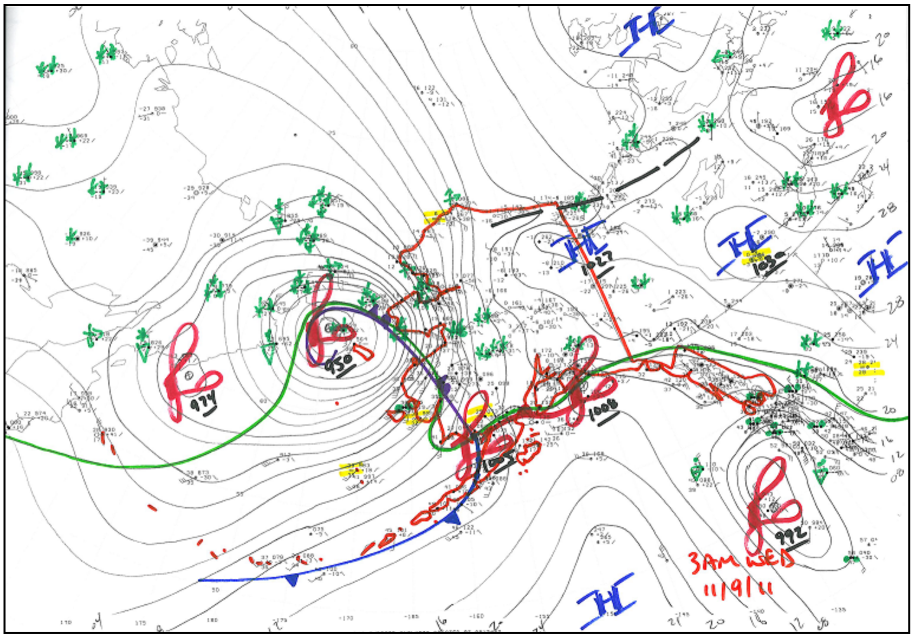


Figure 1: NWS Fairbanks, AK hand surface analysis by forecaster Scott Berg at 0300AKST on November 9, 2011, when the storm was in the northern Bering Sea between Saint Lawrence Island and the Gulf of Anadyr.

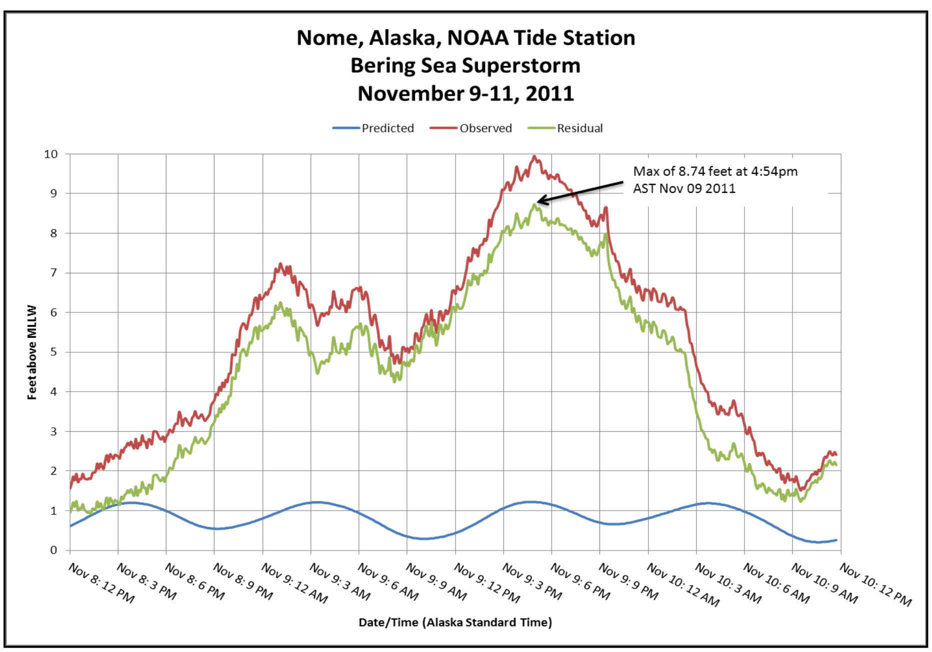


Figure 2: A chart showing the Nome tide gage crest of 8.73 ft above mean low water at 1654AKST on November 9, 2011 (NOAA NOS/CO-OPS).

Continued on next page...

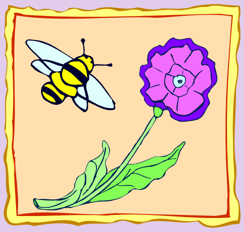
The Bering Sea Storm—Outstanding Storm of the Month - Continued from Page 17

A major impact of the storm was that the last regular fall delivery of fuel to Nome was delayed. Nome is a community of approximately 3,500 people along the west coast of Alaska on the southern Seward Peninsula coast that is only accessible by sea or air. A barge carrying diesel fuel and gasoline was delayed by the storm, and then unable to make it to Nome as the winter sea ice rapidly developed in the week following the storm. In January 2012, a Russian tanker the Renda was escorted by the U.S. Coast Guard icebreaker Healy through approximately 350 miles of ice up to four feet thick and successfully delivered 1.3 million gallons of fuel to Nome. This prevented the fuel from having to be flown into Nome at a much higher cost. This was the first-ever winter marine delivery of fuel to northwestern Alaska.

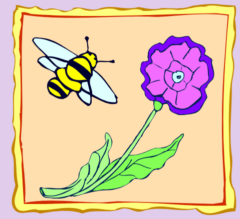
Below, you will find photos **(Figures 3 and 4)** depicting flooding and damage from the Bering Sea Storm.

Figure 3: Ice and water from the Norton Sound deposit debris along the beach and flood Front Street in Nome, Alaska, on November 9, 2011.
Photos courtesy: The National Weather Service Nome (left), AK and Nadja Cavin, The Nome Nugget (right)

Figure 4: Water from the Norton Sound floods several homes in Golovin, Alaska on November 9, 2011 (left). Photo courtesy: Crystal Fagerstrom, Golovin, AK
Water floods a road in Saint Michael, Alaska on November 9, 2011 (right). Photo courtesy: Mark Thompson



Contributors to this Spring 2012 Issue include....



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Please consider contributing to our next edition: Summer 2012